REMARKS

Applicant has amended claims 1, 5, and 7 to more particularly point out and distinctly claim the subject matter which Applicant regards as his invention. Support for this amendment can be found at page 5, line 20 of the Specification. No new matter has been introduced by the amendment. **The proposed amendment should be entered as it raises no new issues that will require further consideration or search and also do not touch the merits of the application within the meaning of 37 C.F.R. § 1.116(b).**

Claims 1-8 are currently pending. Among them, claims 1, 3, 5, and 7 are independent and will be discussed first. Claims 1 and 3 are each drawn to a martensitic stainless steel containing, among others, less than 0.035 wt% C and 0.11-0.25 wt% N, in which the content of $Cr_{23}C_6$ is minimized. Claims 5 and 7 are each drawn to a method of manufacturing such a martensitic stainless steel. Like claims 1 and 3, claims 5 and 7 each recite a steel composition containing, among others, less than 0.035 wt% C and 0.11-0.25 wt% N, in which the content of $Cr_{23}C_6$ is minimized. According to this invention, the content of $Cr_{23}C_6$ is minimized by adjusting the amounts of several elements, particularly by introducing a large amount of N (i.e., 0.11-0.25 wt%) and a small amount of C (i.e., less than 0.035 wt%). See the Specification, page 7, line 17 to page 8, line 2; and page 5, lines 16-21.

The Examiner rejects claims 1-8 under 35 U.S.C. § 103(a) on two grounds. That is, they are obvious over Japanese Patent 2742948 ("the '948 patent") or and are also obvious over Japanese Patent 7-242935 ("the '935 patent"). See the Office Action, page 2, lines 10-12. Applicants disagree and respectfully traverse each ground below.

I

Applicant will discuss the '948 patent first. The Examiner points out that "lines 17 to 22 on page 7 of applicant's specification discloses that only a lower limit of 0.04% N is required to achieve the effect of minimizing $C_{23}C_6$ to improve corrosion rather than the 0.11% stated by applicant." See the Office Action, page 2, lines 20-23. The Examiner then proceeds to conclude that "claims would not [be] patentably distinguish[able from the '948 patent]... since criticality of 0.11 to 0.25% N has not been established (e.g., by comparative data)." See the Office Action, page 2, lines 23-25.

As mentioned above, the content of $Cr_{23}C_6$ is minimized in the steel composition recited in claims 1, 3, 5, and 7 by introducing a large amount of N and a small amount of C, rather than merely introducing at least 0.04 wt% N alone.

Specifically, the content of $Cr_{23}C_6$ is first minimized by the introduction of 0.11-0.25 wt% N. It is well known in the art that a steel composition containing more N has better corrosion resistance. See an on-line publication, a copy of which is attached hereto as "Exhibit A." Specifically, corrosion resistance can be quantified by the pitting resistance equivalent number (PREN), i.e., PREN = %Cr + (3.3 × %Mo) + (30 × %N). Generally, the higher the PREN, the better the corrosion resistance. See Exhibit A, second paragraph. Thus, other components being equal, a steel composition containing 0.11 wt% N possesses much better corrosion resistance than a steel composition containing 0.04 wt% N. Although introducing 0.04 wt% N can decrease the content of $Cr_{23}C_6$, introducing 0.11 wt% N is preferred as it imparts better corrosion resistance to a stainless steel. On the other hand, the toughness of the stainless steel deteriorates when the content of N is above 0.25 wt%. See the Specification, page 7, line 24 to page 8, line 2. Thus, a preferred N range is 0.11-0.25 wt%.

The content of $Cr_{23}C_6$ is further minimized by the introduction of less than 0.035 wt% C. Of note, less C leads to a reduction in chrome carbide, thereby also improving corrosion resistance. See the Specification, page 5, lines 16-21; and page 11, line 16 to page 12, line 1.

Thus, contrary to the Examiner's assertion that the criticality of 0.11 to 0.25 wt% N has not been established, the Specification clearly teaches that adjusting the amounts of both N (i.e., up to 0.25 wt %) and C (i.e., up to 0.035 wt %), rather than adjusting the amount of N only, is critical to minimizing the content of $Cr_{23}C_6$ in the steel composition recited in claims 1, 3, 5, and 7.

Turning to the '948 patent, it describes a steel composition containing 0.03-0.15 wt% N. It does not disclose or even suggest <u>minimizing the content of $Cr_{23}C_6$</u> in a steel composition, a limitation required by claims 1, 3, 5, and 7, let alone minimizing the content of $Cr_{23}C_6$ by including specific amounts of N and C. Further, as Applicant has pointed out in the response to the Office Action of June 18, 2003, to the extent that all of the preferred embodiments presented in the '948 patent disclose steel compositions containing less than 0.11 wt% N, the '948 patent

teaches away from amended claims 1, 3, 5, and 7, each of which requires that the recited steel compositions contain at least 0.11-0.25 wt% N. Thus, claims 1, 3, 5, and 7 are patentably distinguishable from the '948 patent and are not rendered obvious by it.

Even if a *prima facie* case of obviousness has been made (which Applicant does not concede), it can be successfully rebutted by a showing of unexpected advantages of a stainless steel composition recited in claims 1, 3, 5, and 7. Specifically, Applicant submits that a stainless steel composition containing 0.11-0.25 wt% N and less than 0.035 wt% C possesses improved corrosion resistance and mechanical properties.

First, the steel composition described in Example 6 of the Specification possesses better mechanical properties than that described in Example 9 of the '948 patent. According to the Examiner, "prior art example 9 meets the claimed composition except for a slightly lower amount of 0.081% N." See the Office Action, page 2, lines 15-18. Indeed, the steel composition described in Example 3 of the Specification (i.e., containing 0.08 wt% N, 16.0 wt% Cr, and 1.0 wt% Mo) is similar to that described in Example 9 of the '948 patent (i.e., containing 0.081 wt% N, 15.97 wt% Cr, and 0.97 wt% Mo). Yet, the steel composition described in Example 3 of the Specification has a hardness of 392 Hv and a yield strength of 98.8 Kg/mm^2, much lower than those of the steel composition described in Example 6 of the Specification (i.e., 429 Hv and 110.2 Kg/mm^2, respectively).

Second, the steel composition described in Example 6 of the Specification (containing 0.11 wt% N and 0.02 wt% C) possesses better corrosion resistance than those described in Examples 7 and 8 and Comparative Examples 5 and 6 (containing a similar amount of N but a larger amount of C). Specifically, the steel composition described in Example 6 of the Specification has a corrosion rate (1.7 mm/year) much lower than those of the steel compositions described in Examples 7 and 8 and Comparative Examples 5 and 6 (2.5, 2.9, 3.7, and 4.6, respectively).

Thus, given these unexpected advantages, claims 1, 3, 5, and 7 are clearly not rendered obvious by the '948 patent. Neither are claims 2, 4, 6, and 8, all of which dependent from them.

II

Applicant now discusses the '935 patent. The Examiner points out that "Applicant has not established criticality of the narrow N range of 0.11 to 0.25% since his specification

discloses [that] 0.04% N is sufficient to minimize the content of $Cr_{23}C_6$ to improve corrosion resistance, and because there are no comparative test examples to support criticality of 0.11% N. Hence the more narrowly define[d] N range of 0.11 to 0.25% would not define patentable novelty of JP'935 broader N range of 0.01 to 0.25%." See the Office Action, page 3, lines 1-5.

The '935 patent describes a steel composition containing a broad range of N (i.e., 0.01-0.25 wt%) and C (i.e., 0.01-0.30 wt%). It does not disclose or suggest that <u>the content of $Cr_{23}C_6$ is minimized</u> in a steel composition, a limitation required by claims 1, 3, 5, and 7.

Further, the Specification has shown that adjusting the amounts of both N (to 0.11-0.25 wt%) and C (to less than 0.035 wt%), rather than adjusting the amount of N only, is critical to minimizing the content of $Cr_{23}C_6$ in the steel composition recited in claims 1, 3, 5, and 7.

Thus, contrary to the Examiner's assertion, the narrowly defined ranges of N (i.e., 0.11-0.25 wt%) and C (i.e., less than 0.035 wt%) are patentably distinguishable from the broader range of N (i.e., 0.01-0.25 wt%) and C (i.e., 0.01-0.30 wt%) disclosed in the '935 patent.

The Examiner also points out that "specific example 244 on page[s] 31 and 32 [of the '935 patent] meets the claimed composition except contains 0.06% C whereas [original claim 1] recites less than 0.06% C. Although the prior art does not disclose or suggest a steel composition in which the content of $Cr_{23}C_6$ is minimized, such would inherently occur because the compositional limitations are closely met, and in absence of proof to the contrary." See the Office Action, page 3, lines 8-11. Applicants disagree. Each of claims 1, 3, 5, and 7, as amended, recites a steel composition containing less than 0.035 wt% C. The '935 patent describes in example 244 a steel composition containing a much higher C content, i.e., 0.06 wt% C. Indeed, to the extent that the '935 patent discloses a broad range of N (i.e., 0.01-0.25 wt%) and C (i.e., 0.01-0.30 wt%), it does not suggest that the content of $Cr_{23}C_6$ is minimized by the introduction of both a large amount of N (i.e., 0.11-0.25 wt%) and a small amount of C (i.e., less than 0.035 wt%). Thus, contrary to the Examiner's assertion, minimizing the content of $Cr_{23}C_6$ does not occur inherently in steel compositions described in the '935 patent.

In any event, any *prima facie* case of obviousness established by the Examiner can be successfully rebutted by Applicant's showings that a steel composition containing 0.11 wt% N and less than 0.035 wt% C possesses improved corrosion resistance and mechanical properties. See Part I above.

For the reasons set forth above, claims 1, 3, 5, and 7 are not rendered obvious by the '935 patent. Neither are claims 2, 4, 6, and 8, all of which depend from them.

CONCLUSION

Applicant submits that the grounds for rejection asserted by the Examiner have been overcome, and that claims 1-8, as pending, define subject matter that is non-obvious. On this basis, it is submitted that all claims are now in condition for allowance, an action of which is requested.

Enclosed is a check for the Petition for Extension of Time fee. Please apply any other charges to deposit account 06-1050, referencing Attorney's Docket No. 12568-002001.

Respectfully submitted,

Date: 4-5-04

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1. Abstract

INCOLOY alloy 25-6MO (UNS N08926) is a fully austenitic alloy containing 6% molybdenum and 0.2% nitrogen, which offers excellent corrosion resistance in a wide variety of aggressive, aqueous environments. It replaces conventional, austenitic stainless steels (UNS S31600 and S31700), where their capabilities are pushed to their performance limits.

One of the outstanding attributes of alloy 25-6MO is its resistance to environments containing chlorides or other halides. Alloy 25-6MO offers excellent resistance to pitting and crevice corrosion. Performance in resisting these types of corrosion is often measured using Critical Pitting Temperature (CPT), Critical Crevice Temperature (CCT), and Pitting Resistance Equivalent Number (PREN = %Cr + (3.3 x % Mo) + (30 x %N)). Corrosion properties of stainless steels are basically dependent on their chemical compositions. As a general rule, the higher the PREN, the better the resistance to pitting corrosion. However, alloys having similar values may differ considerably in actual service. Those alloys with values greater than 38 on the PREN scale offer more corrosion resistance than austenitic stainless steels such as 316 and 317 with a PREN $\leq$ 31. Alloy 25-6MO, with its PREN of 47, offers a cost-effective means to avoid aggressive chloride attack. Resistance to environments containing chloride or other halides, makes the alloy highly suitable to environments such as brackish water, seawater, caustic chlorides and pulp mill bleaching solutions.

The nickel and chromium contents of alloy 25-6MO make it resistant to a wide range of corrosive environments. The alloy is especially resistant to non-oxidizing acids such as sulfuric and phosphoric. The high molybdenum and nitrogen content provide resistance to pitting and crevice corrosion, while copper enhances resistance to sulfuric acid.

Alloy 25-6MO exhibits excellent resistance to sulfide stress cracking (hydrogen embrittlement) and chloride stress corrosion cracking in sour brine oil field environments. The alloy is included in the NACE International Standard Materials Requirement MR0175 for "Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment".

The alloy also exhibits excellent resistance to Microbiologically Influenced Corrosion (MIC). Because of resistance to MIC, alloy 25-6MO and other 6% molybdenum austenitic stainless steels are being used in service water piping systems of power plants.

Applications include its use in chemical and food processing, pulp and paper bleaching systems, marine and offshore platform equipment, desalination units, salt plant evaporators, air pollution control systems, as well as condenser tubing, service water piping and feedwater heaters in the power industry. Alloy 25-6MO is

approved under the Boiler and Pressure Vessel Code of the American Society of Mechanical Engineers (ASME). The ASME Code Case 2120 (Ni-Fe-Cr-Mo-Cu-low Carbon alloy N08926) defines the chemical composition, maximum allowable stress values, and the mechanical property requirement for the alloy.